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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/562,893	12/29/2005	Bart Gerard Bernard Barenbrug	NL 030758	6934

24737 7590 09/04/2007
PHILIPS INTELLECTUAL PROPERTY & STANDARDS
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EXAMINER	
AMIN, JWALANT B	

ART UNIT	PAPER NUMBER
2628	

MAIL DATE	DELIVERY MODE
09/04/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/562,893	BARENBRUG ET AL.
	Examiner	Art Unit
	Jwalant Amin	2628

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 December 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 December 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☒ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 6-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

3. Claim 6 recites the limitation "the 3D mipmap level mml of the associated 3D mipmap" in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim.

4. Claim 7 recites the limitation "the 3D mipmap level mml of the associated 3D mipmap" in line 2, and the limitation "$fmml_v$" in line 3 of the claim. There is insufficient antecedent basis for these limitations in the claim. Since $fmml_v$ is determined in claim 3, for the purpose of prior art rejection, the examiner interprets that claim 7 is dependent on claim 3.

5. Claim 8 recites the limitation "the 3D mipmap level mml of the associated 3D mipmap" in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim. For the purpose of prior art rejection, the examiner interprets that claim 8 is dependent on claim 3.

6. Claim 9 recites the limitation " the 3D mipmap level mml of the associated 3D mipmap" in the first two lines, and the limitation "$fmml_v$" in line 3 of the claim. There is insufficient antecedent basis for these limitations in the claim. Claim 9 depends on claim

8. However, claim 8 is not dependent on claim 3, but is dependent on claim 4. Since fmml$_v$ is determined in claim 3, for the purpose of prior art rejection, the examiner interprets that claim 8 is dependent on claim 3. Thus, claim 9 is dependent on claim 8, which is further dependent on claim 3.

Claim Rejections - 35 USC § 101

7. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

8. Claim 12 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

9. Regarding claim 12, the language of the claim raise questions as to whether the claim is directed merely to an abstract idea that is not tied to a technological art, environment or machine which would result in a practical application producing a concrete, useful, and tangible result to form the basis of statutory subject matter under 35 U.S.C. 101. Specifically, a computer program to perform a method, as disclosed in claim 12, directed to a mere arrangement of data, which is an abstract idea that do not correspond to any specific real world data. These claims do not claim any "practical application" or "useful, concrete and tangible result". See MPEP 2106 IV (B)(1).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1-3, 5-7 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larson et al. (US 5,222,205; hereinafter Larson), in view of Ewins et al. ("Mip-Map Level Selection for Texture Mapping"; hereinafter Ewins), in view of Lee et al. (US 6,057,861; hereinafter Lee) and further in view of Brokenshire et al. (US 6,738,070; hereinafter Brokenshire).

12. Regarding claims 1, 11 and 12, Larson teaches a texture memory (VRAMS on the frame buffer) for storing texture maps in a mipmap (RIP map are rectangular mipmaps) structure (col. 7 lines 36-45); texels in a texture map being specified by a pair of u and v coordinates (fig. 2; col. 6 lines 66-68 and col. 7 lines 1-5); a rasterizer (col. 6 lines 16-18) and a texture mapper for mapping the obtained texture data to corresponding pixel data defining the display image (col. 8 lines 6-50 and Fig. 4). Larson further teaches to apply down-sampling (magnification factor) in S direction and T direction to the texture map (col. 7 lines 47-59).

Although Larson teaches the claimed limitations as stated above, Larson does not explicitly teach to determine corresponding initial 4D mipmap levels (mml_u, mml_v); to determine a magnification factor representing a magnification that occurs when the texel is mapped to a corresponding pixel position on the display. However, Ewins teaches the process of progressively averaging groups of four neighboring texels to form each new layer of the pyramid from the initial, full detail, or base texture level, referred to as level 0 (pg. 318 col. 1 last four lines, col. 2 line 1; full detail texture refers to the magnification

factor of 1, which is the original texture map). Ewins further teaches to calculate the texture minification and the related mip-map level (pg. 318 col. 2, pg. 319 col. 2, pg. 320-pg. 325; texture minification, j corresponds to magnification factor). Larson further teaches to find the final mip-map level based on the texture minification j (pg. 325). Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to determine the mip-map levels and the texture minification ratio as taught by Ewins and apply it into the system of Larson because the quality of the images produced by bilinear and trilinear filtering is largely dependent upon the mip-map level selection and the calculated trilinear interpolation fraction using the texture minification ratio (pg. 327 col. 2 last paragraph).

Although the combination of Larson and Ewins teach the claimed limitations as stated above, they do not explicitly teach to determine the corresponding final 4D mipmap levels in dependence on the determined initial 4D mipmap levels and the magnification factor. However, Lee teaches a rip map stored in a 2-dimensional data array (4D mipmap), which can be differently subsampled in each direction U and V. Lee further teaches two levels of subsampling (du, dv) used to designate a specific data array (col. 3 lines 23-64; subsampling in U direction corresponds to magnification factor in U direction; subsampling in V direction corresponds to magnification factor in V direction; levels of subsampling (du, dv) used to designate the data array corresponds to the 4D mipmap levels (mml_u, mml_v)). Lee further teaches the relationship between the subsampling in u direction and the level of subsampling du and the relationship between the subsampling in v direction and the level of subsampling dv (Table 1, col. 3 lines 46-

64; subsampling in U direction, which is the magnification factor in U direction is equal to 2^{-du}; subsampling in V direction, which is the magnification factor in V direction is equal to 2^{-dv}; therefore if the magnification factor is each direction is known, the final mipmap levels in that direction can be determined using this relationship). Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to determine the mipmap levels as taught by Lee and apply it into the system of Larson and Ewins because these levels are used to designate a specific rip map data array, which provides more choices in subsampled data for use in interpolation and reduces aliasing and blurring artifacts (col. 3 lines 41-67).

Although the combination of Larson, Ewins and Lee teach the claimed limitations as stated above, they do not explicitly teach a texture space resampler (processor 111 configured to perform texturing function, fig. 1) for obtaining texture data (step 212, fig. 2) from a texture map (mipmaps) identified by the pair of final 4D mipmap levels ((LOD_u, LOD_v)). However, Brokenshire teaches exactly the same (col. 2 lines 17-52, col. 3 lines 3-32). Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to fetch desired mipmap from the memory using level of detail as taught by Lee and apply it into the system of Larson, Ewins and Lee because storing and retrieving mipmaps using level of detail as addresses is efficient and saves time (col. 1 lines 29-30).

13. Regarding claim 2, the combination of Larson and Ewins teach the limitations as stated above, except that they do not teach the magnification factor represents a magnification in a vertical direction indicated by coordinate v. However, Lee teaches

exactly the same (col. 3 lines 23-64; subsampling in V direction corresponds to magnification factor in V direction; the subsampled array of the rip map need not be sampled in each direction U and V the same; the data array 65' is ½ subsampled only in V direction). Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to magnify in a vertical direction as taught by Lee because such a rip map data array provides more choices in subsampled data for use in the interpolation, which reduces aliasing and blurring artifacts (col. 3 lines 65-67).

14. Regarding claim 3, Larson teaches to prefilter (down-sample) a 4D mipmap and store in the frame buffer memory (col. 7 lines 36-63).

Although Larson teaches the limitations as stated above, Larson does not explicitly teach to determine a final vertical 4D mipmap level $fmml_v$ by adjusting mml_v to identify a lower resolution vertical 4D mipmap level if the magnification factor is less than a predetermined threshold and maintaining the determined mml_v mipmap level otherwise. However, Ewins teaches to determine the magnification factor, which is used to determine the level of detail of the mipmap (see rejection of claim 1 for further details). It is noted that each prefiltered mipmap level has a predetermined number of samples, and therefore the number of samples in a mipmap level determined by the magnification factor that is closest to the number of samples in a prefiltered mipmap level is selected (For example, if the number of samples in a mipmap level determined by the magnification factor falls between two prefiltered mipmap levels with different number of samples, then the prefiltered mipmap level with the number of samples closest to the one determined by the magnification factor is selected; therefore,

depending on the number of samples determined by the magnification factor, a prefiltered mipmap level is selected; see pgs. 318, 319, 325). Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to select the mipmap level depending on the number of samples determined by the magnification factor as taught by Ewins because selecting the prefiltered mipmap level that has the number of samples closest to the number of samples determined by the magnification factor results in a better resolution quality of image (pg. 327 col. 2 last paragraph).

15. Regarding claim 5, Larson teaches the texture memory (VRAMs on the frame buffer) is arrange to store the texture maps (down-sampled texture maps) in a 3D mipmap structure (col. 7 lines 23-45); each texture map being identified by a respective 3D mipmap level mml (col. 7 lines 2-18); the texture space sampler is operative to reconstruct at least part of a texture map of an identified 4D mipmap from an associated 3D mipmap with level mml in the texture memory (col. 7 lines 23-45; it should be noted that the rip map 200 (fig. 3) is produced by downsampling each texture map (of equal S and T dimensions) in one direction (S or T) within the mipmap). However, Larson does not explicitly teach on-the-fly reconstruction. Nonetheless, it would have been obvious to one of ordinary skill in art at the time of present invention to utilize on-the-fly reconstruction in order to reconstruct at least part of texture map of a 4D mipmap from said 3D mipmap because storing the original 3D image and simply generating the ripmap (4D mipmap) image from the original 3D image when desirable would save storage space.

16. Regarding claim 6, Larson teaches the 3D mipmap level mml of the associated 3D mipmap (col. 7 lines 2-18; it should be noted that Larson teaches a mipmap forming a pyramid has different levels;). The examiner further interprets that if the magnification factor is less than a predetermined threshold, then $mml_v = fmml_v$, and thus 3D mipmap level is given by Max (mml_u, mml_v). However, Larson further teaches that each down-sampled version of each component is a square, symmetrical version of its parent (for a mipmap, the downsampling in both the directions is same; for example row 2, column 2 of fig. 3 displays a downsampled texture map in a ripmap where the downsampling is same in both U and V directions, i.e. $mml_u = mml_v$; since Larson teaches that a mipmap is a square, symmetrical version of its parent, the downsampled texture map of row 2, column 2 of fig. 3 is also a mipmap; the level for this downsampled texture map is given by downsampling in any one direction; col. 7 lines 6-45 and figs. 2A-2B and 3). Therefore, the 3D mipmap level is essentially given by Max (mml_u, mml_u), which will result in mml_u. Thus, the 3D mipmap level mml of the associated 3D mipmap is mml_u.

17. Regarding claim 7, please refer to the rejection of claim 6 regarding how the $mml_v = fmml_v$ and $mml_u = mml_v$. Further the examiner interprets that Min (mml_u, $fmml_v$) = Min (mml_u, mml_v) = Min (mml_u, mml_u) will result in mml_u. Thus, the 3D mipmap level mml of the associated 3D mipmap is mml_u.

18. Regarding claim 10, Larson teaches a central processing unit, a memory, a display, and a system (col. 5 lines 25-31, col. 6 lines 4-15, Fig. 1).

19. Claims 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larson, Ewins, Lee and Brokenshire, and further in view of Buchner et al. (US 5471572).

20. Regarding claim 4, Larson teaches the texture memory (VRAMs on the frame buffer) is arranged to store the texture maps in a 4D mipmap structure (col. 7 lines 36-45; RIP map are rectangular mipmaps corresponds to 4D mipmap structure).

Although the combination of Larson, Ewins and Lee teach the claimed limitations as stated above, they do not explicitly teach each texture map (mipmap) being identified by a pair of 4D mipmap levels ((LOD_u, LOD_v)). However, Brokenshire teaches exactly the same (col. 2 lines 17-52, col. 3 lines 3-32). Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to identify the mipmap by a pair of mipmap level as taught by Lee and apply it into the system of Larson, Ewins and Lee because storing and retrieving mipmaps using level of detail as addresses is efficient and saves time (col. 1 lines 29-30).

Although the combination of Larson, Ewins, Lee and Brokenshire teach the claimed limitations as stated above, they do not explicitly teach the texture resampler is operative on the fly to reconstruct at least part of a texture map of a 4D mipmap identified by initial 4D mipmap levels from a texture map of a 4D mipmap in the texture memory identified by the final 4D mipmap level for use by the rasterizer. However, Buchner teaches exactly the same (col. 7 lines 35-52, Fig. 3B; it should be noted here that the low-resolution texture image (base texture is the texture map identified by final mipmap level) as taught by Buchner (Fig. 3B) and the zoomed-base texture (texture

map identified by initial mipmap level) (Fig. 3B) can be interpreted as ripmaps or 4D mipmaps because a square with n-by-b sides is also by definition a rectangle; moreover the zoomed base texture is created by interpolating the data from the base texture as necessary, and thus it is considered to perform on-the-fly operation). Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to reconstruct a zoomed base texture from a base texture as taught by Buchner and apply it into the system of Larson, Ewins, Lee and Brokenshire because the reconstructed zoomed base texture with level of detail associated with the original texture image is used to generate a frequency band map (col. 7 lines 5-15 and lines 53-55).

21. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larson, Ewins, Lee, Brokenshire, and Buchner, and further in view of Meltdown ("Anisotropic Texture Filtering").

22. Regarding claim 8, the combination of Larson, Ewins, Lee, Brokenshire, and Buchner disclose the limitations as stated above, except they do not explicitly teach the 3D mipmap level mml of the associated 3D mipmap is determined in dependence on a predetermined maximum anisotropy level a. However, Meltdown shows that the minor depends on the inverse of maximum anisotropy, and mipmap level is a function of minor (pg. 11). Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to determine mipmap level depending on a predetermined maximum anisotropy as taught by Meltdown and use it into the system of Larson, Ewins, Lee, Brokenshire and Buchner because using the inverse of maximum

anisotropy to calculate the level of detail makes sure that it does not exceed minimum and maximum bounds (pg. 10-11).

23. Regarding claim 9, please refer to the rejection of claim 6 regarding how the $mml_v = fmml_v$ and $mml_u = mml_v$. Further the examiner interprets that Max (Max (mml_u, $fmml_v$) – a, Min (mml_u, $fmml_v$)) = Max (Max (mml_u, mml_u) – a, Min (mml_u, mml_u)) = Max (mml_u – a, mml_u), which will result in mml_u. Thus, the 3D mipmap level mml of the associated 3D mipmap is mml_u.

Conclusion

24. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Ito (US 6925204)

25. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jwalant Amin whose telephone number is 571-272-2455. The examiner can normally be reached on 9:30 a.m. - 6:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Zimmerman can be reached on 571-272-7653. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

*** J.A. 8/29/07

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